KENTUCKY ENERGY AND ENVIRONMENT CABINET

Trail Management Resources

Kentucky Heritage Land Conservation Fund
375 Versailles Road, Frankfort, KY 40601
502-573-3080
http://heritageland.ky.gov

Adapted from 2003 Kentucky Department of Parks manual

Agencies receiving land acquisition/management funding for recreational hiking trails from the Kentucky Heritage Land Conservation Fund should incorporate this information into their Final Resource Management Plans. These resources cover the most basic trail management issues that affect natural areas – they are not comprehensive, but intended to be a starting point for management considerations. Not every KHLCF project will address all of these issues, and some projects will address issues not touched upon here. Funding recipients are urged to contact the KHLCF office for assistance, not just during the planning process but any time any management issues arise.

Table of Contents

These are based on those developed for the trails on Kentucky's state parks in 2003 under Carey Tichenor, Kentucky Department of Parks Chief Naturalist. All photos taken by Zeb Weese unless otherwise noted.

Introduction to Hiking Trails

The Kentucky Heritage Land Conservation Fund (KHLCF) recognizes that public access to KHLCF sites is very important.

By statute (KRS 146.560), the KHLCF may fund properties that meet the following priorities for acquisition:
(a) Natural areas that possess unique features such as habitat for rare and endangered species;
(b) Areas important to migratory birds;
(c) Areas that perform important natural functions that are subject to alteration or loss;
(d) Areas to be preserved in their natural state for public use, outdoor recreation and education.

By regulation (418 KAR 1:010), outdoor recreation and education on KHLCF sites must not impair the "natural state" of the site:
418 KAR 1:010 (17) "Natural state" means the condition of any area which retains, has substantially reestablished, or is in the process of reestablishing, an indigenous ecosystem.
418 KAR 1:010 (18) "Outdoor recreation" means activity on a subject property that does not cause meaningful harm to the property or its natural state, or hinder the heritage land conservation purposes of KRS 146.550 through 146.570.

NOTE: All KHLCF-funded sites are legally protected in perpetuity by the KHLCF through conservation easements, etc. Approximate trail routes must be included in the application's preliminary Resource Management Plan (RMP). After the site biological and archeological inventories are completed, trail routes must be finalized to protect any sensitive areas. Detailed trail routes must be approved by the KHLCF Board as part of the site final Resource Management Plan prior to trail construction. Remember to keep this document and the most recently approved RMP when making management decisions on any KHLCF site. For questions and support regarding management issues, please contact the KHLCF office.

In order to increase visitor safety, provide a better public service, and enhance stewardship of resources, the Kentucky Heritage Land Conservation Fund (KHLCF) has supplied the following information for the management of trail systems. These resources are based on those developed by the Kentucky Department of Parks Division of Recreation & Interpretation in 2003, which are used to maintain some of the Commonwealth's steepest and most heavy-used hiking trails, such as the 22 miles at Natural Bridge State Park. Information has been provided on designing and laying out trails, as well as construction and maintenance techniques, and signage. The KHLCF has determined that in many cases hiking trails have been designed and maintained as if they were roads; this is neither cost-effective nor compatible with natural area conservation. The use of heavy equipment (back-hoes, etc.) or even smaller equipment (skid-steers, etc.) is generally unnecessary. Similarly, designing forest trails to be

maintained by a tractor or riding mower is discouraged, as is the use of materials such as gravel or mulch. Mowing open-field trails may be acceptable in certain situations.

NOTE: In rare cases mowed trails through a field may be unavoidable. Due to added maintenance issues and cost these should be kept to a minimum. In cases where they are necessary, the other issues discussed in this document still pertain.

A well-designed trail should be no wider than two feet and be maintained by one or two people on an occasional basis. Initial construction of trails, and occasional rehabilitation of damaged areas, will usually require extensive manual labor for several days (depending on the length and topography of the trail), but regular maintenance is much less time-consuming. Generally all that is needed to maintain a well-designed forest trail is to hike it 3 or 4 times each year while carrying a chainsaw to remove downed limbs and a tool to clean out drainage features. By comparison, if that same trail is maintained by a mower it will need to be mowed at least weekly from April until August - if it is maintained by gravel or mulch, the cost of materials and fuel are also factors.

NOTE: In general, a properly designed hiking trail will save on long-term maintenance costs, including labor, materials, and fuel; just as importantly, it is more environmentally friendly.

Any major modifications to KHLCF trails must go through a review process. Modifications include the relocation of existing trails, new trail design and construction, changes in use designation, trail closures, and major trail renovation. Any plans that would include any of these modifications should be submitted to the KHLCF for review and approval.

NOTE: The sources referenced in this document are for informational use only. Major trail modifications always need the approval of the KHLCF.

For specific maintenance instructions refer to the Appalachian Trail Conference's "Trail Design, Construction, and Maintenance" book. This publication gives detailed information on trail construction and maintenance techniques including proper tools, safety, and materials. The web-site of the non-profit "American Trails" also has design and maintenance instructions. For more information see the "Trail Design and Construction Resources" section of this document.

This document has been developed for the overall benefit of the resources, visitor enjoyment, and easier long-term maintenance. They have been developed by natural resource professionals with decades of experience in trail construction and maintenance throughout the Commonwealth of Kentucky. For questions and support regarding trail issues, please contact the KHLCF office.

NOTE: All KHLCF-funded sites are legally protected in perpetuity by the KHLCF through conservation easements, etc. Remember to keep this document and the

most recently approved Final Resource Management Plan when making management decisions on any KHLCF site. For questions and support regarding management issues, please contact the KHLCF office.

Trail Planning and Design

Trail planning and design is the first and most important process for staff to undertake before any trail construction or renovation work is begun. This section will provide you with information on how to properly plan and design a trail project.

Every trail has to have an approved plan and design included in the site's Final Resource Management Plan. The KHLCF can provide assistance during this planning and design phase.

Planning and Design Objectives

A well-planned and designed trail project should reflect five (5) basic objectives:

1. A trail project should impact lightly on the natural & historical resources.

2. A trail project should provide a quality experience for its users.

3. A trail project should provide for the general safety of the user.

4. A trail project should minimize user conflicts.

5. A trail project should be easily maintainable and within the scope of the managing agency's staff and budget.

Trail Concept

Every trail project begins as a concept: someone has an idea that a trail is needed. The planning and design process begins with the evaluation of a trail concept by the managing agency, who must decide whether the trail project concept has merit. Five (5) decisions must be made for every trail concept proposed:

1. Can the trail project be accomplished as proposed with regard to natural resource limitations?

2. Would the trail benefit visitors?

3. What user groups or groups will this trail project serve?

4. Will the managing agency be able to accept the long-term maintenance responsibility for the trail with its current staff and operational budget after all KHLCF funds are expended?

5. Does the trail concept conflict with any other short-term or long-term plans?

Should the managing agency and the KHLCF find the new trail concept has merit, the next step in the process is to study the proposed location of the project by using a topographic map of the site and other available resource information.

Trail Mapping

The second step in the process is to study and identify the location of the proposed trail project on a topographic map of the site. These maps provide staff with information on the location of valleys, ridges, flat lands, watersheds, and man-made structures. If the managing agency has access to ArcGIS or other mapping software, this can also be useful. From the information depicted on a topographic map, staff can determine if the new trail project can be accomplished and help in deciding the following:

- Can the conceptual trail be built on the ground as conceived?
- What are the best routing alternatives for the trail project?
- How will the project tie into existing infrastructure and other trails?
- How can the trail project be routed to minimize the number of water crossings?
- How can the trail project be routed to minimize the crossing of steep terrain?
- How can the trail be routed to minimize the number of man-made structures such as footbridges, steps, and stairways?

NOTE: Information regarding the location of protected, endangered or threatened plants, animals, and natural communities is essential for trail planning. This information should be compiled through a biological inventory prior to any trail planning. Trails should always avoid any impacts to significant biological or archeological resources.

Trail Design

The next step is to field check the proposed trail location now identified on the topographical map. This is accomplished by walking the proposed trail alignment. It is during field design that the following decisions should be made.

- Determine whether the proposed trail project can be constructed as envisioned.
- Determine the trail project route “on the ground” and map with a GPS.
- Determine the width of the trail tread in accordance with the trail standards provided in this document.

- Determine what trail surface option will be used in compliance with the trail standards provided in this document.

- Determine if the trail to be constructed is within the grade limitations specified in the standards provided in this document.

- Determine what structures will be needed to complete the trail. This includes the widths and lengths of bridges, stairs, steps, and railings. NOTE: All structures will eventually require maintenance and increase liability; the KHLCF discourages building structures unless absolutely necessary.

- Determine the total length of the trail project.

- Determine if any other trail related facilities are needed. This includes kiosks, parking, shelters, benches, and restrooms.

- Estimate the construction time and material costs.

- Determine if the trail project can be accomplished and managed with existing staff and budget.

It is very important to keep field notes of decisions made during the field design process. These notes can be critical when developing proposal for grants or other funding requests.

Trail Flagging

Trail design involves flagging the trail alignment. This process includes:

- Flag the proposed trail alignment by tying surveyors' tape to trees and limbs along the route.

- Using a clinometer can ensure that the grade is kept within the standards provided in this document.

- Because the final trail alignment is subjective, the initial flag line may be changed numerous times before a final decision is agreed upon.

- The use of different colors of surveyors' tape will help keep the various flagged routes separate.

- When a final trail alignment is established, this alignment should be flagged using only one color of surveyor flagging. All other flagging must be removed to eliminate confusion.

- Noting the final trail alignment on the topographical map will provide valuable information to management and the KHLCF during the approval process. If the managing agency has GPS or ArcGIS capabilities, providing the KHLCF a shapefile of the trail route is also helpful.

Final Trail Project Alignment and Design Review

The managing agency shall submit the design to the KHLCF for review and approval before construction begins. The KHLCF will schedule a date and time for a final walk through of the trail alignment and review of the trail design decisions. If any GPS or ArcGIS information has been compiled, provide the KHLCF with a copy of the shapefile.

Trail Construction Process

Trail construction is the process of building a well-planned and designed trail. A properly constructed trail will be aesthetically pleasing to the visitor, impact lightly on the natural resources and be a manageable function of the staff's responsibilities. Trail construction involves the following processes.

- Trail corridor clearing
- Construction of the trail tread

NOTE: Forest hiking trail construction is manual-labor intensive, but if done properly it will result in very little long-term maintenance. The KHLCF does not recommend the use of heavy equipment (bulldozers, skid-steers, tractors) in trail construction as it generally results in a trail that requires much more maintenance and has a negative impact on the environment.

Trail Corridor Clearing

This process involves the selective removal of limbs, brush, trees and other vegetative growth within the trail corridor. Removal of this vegetation should serve to give direction to the trail by providing a visible corridor.

Trail corridor clearing activities should be performed in compliance with the standards provided in the trail uses section of this document.

For the trail appearances and erosion protection, leave all healthy trees over 5 inches in diameter if such trees will not interfere with the trail user or cause the grade of the trail to be greater than 12 percent.

In sparsely timbered areas, the trail should be located to avoid the need to remove healthy trees except where they interfere with the trail user.

Trail Corridor Clearing Techniques

Techniques for trail corridor clearing are as follows:

- Remove all branches encroaching upon the trail tread from ground level to approximately 7 feet high (i.e. as high as an average person can reach with a pair of pruners/loppers). Cut off branches one-half inch from the trunk of the tree to allow the bark of the tree to grow over the cut off limb and heal cleanly. Never leave a stub as a visitor might fall against it.
- Cut all trees and brush outside the tread itself level with the ground or grub out the root so that no stubs protrude.

- Remove and dispose all limbs out of sight of the trail. If this is not possible, scatter the debris in such a manner that it does not create an eyesore along the trail. Weed cuttings may be left to decompose.

- The leaf matter and herbaceous vegetation (humus layer) on the ground needs to be cleared away to define your trail pathway and expose the natural surface. The width to be exposed will depend on the type of trail uses allowed and should meet the standards provided in the trail uses section of this document. At a minimum an 18 inch tread should be cleared. The best tools for this job is a fire rake or leaf-blower.

Trail Construction Techniques

The trail tread construction process involves several processes including techniques for water diversion, water crossings, in-ground and elevated steps, and surface stabilization. There are various tread construction techniques for the different terrain the trail will cross. These include:

- Side-hill Trail Construction
- Water-bars or “dips"
- Switchbacks
- Cribbing and Retaining Walls
- In-Ground Steps & Stairways
- Footbridges

Note: Detailed information and instructions, along with illustrations, on these construction methods are in the “Trail Design, Construction, and Maintenance” book. See “Trail Resources” section of this document.

Note: Almost all drainage problems can be solved by properly constructed dips, water-bars, or switchbacks.

Standards for Forest Hiking Trails

The following standards provide minimum and maximum guidelines for trail construction, renovation and relocation projects.

These guidelines provide the latitude to plan, design, and construct a trail that is safe and aesthetically pleasing for the trail user, impacts lightly on the park's natural resources and that will be a manageable facility for the staff. As a general rule, trails should be developed using the most natural materials possible while protecting the natural resources of the site and providing safe, enjoyable visitor experiences.

The majority of designated trails funded by the KHLCF are single use trails for foot travel only. Any motorized use of trails is prohibited.

NOTE: Adhering to these guidelines should result in an effective, low-maintenance forest hiking trail. It will also help deter access by illegal and undesirable users, e.g. motorized vehicles.

Trail Tread Width

The trail tread width should be determined during the trail planning and design process. For hiking trails, a tread width 18 – 24 inches should be the standard. Trails that get extremely heavy use, or include routes that have been historically used for other uses i.e. old logging roads, can be wider, but still maintained to as narrow a width as possible (under 6 feet). This will create a closed tree canopy above the trail and discourage weeds/grass from creating maintenance issues. It will also discourage undesirable encroachment, such as ATV use.

Trail Corridor Width & Height Clearances

Width & height clearances of the trail corridor should be determined during the construction process. In most cases, the width of the corridor should not exceed 24 inches beyond either side of the trail tread surface.

On trail sections where the side slope is steep (greater than 10%) the width of the corridor should be cleared 24 inches beyond the up-slope trail tread. The down-slope side of the trail should only be cleared to the edge of the trail tread. This will discourage the trail users from using the down-slope edge of the trail tread and reduce the breakdown of the down-slope edge of the trail.

The trail corridor height should be cleared of branches and limbs below 7 feet in height.

Grades

Grade refers to the degree or percentage of inclination of various sections of the trail. The grade should be determined during the planning and design process and efforts

should be made to avoid steep terrain wherever possible. This can be accomplished by following the contours of the land by use of a topographical map and selecting the direction of least resistance.

NOTE: Where steep areas can not be avoided, methods should be selected to minimize erosion. This can include the use of switchbacks, dips, water-bars, and in-ground steps. Heavy equipment is not needed.

Footbridges

Footbridges should be built across any drainage that has steep banks, carries water throughout most of the year, or where a natural crossing is not safe or feasible. As a general rule, the bridges should be constructed to blend with the natural surroundings and enhance the other trail features. Different styles and types of bridges can be found in the "Trail Design, Construction, and Maintenance" book. However, these general guidelines should be followed. The width of the bridge should be determined by the amount and type of trail use, and the overall design features of the trail. In no circumstance should the width have to exceed 36 inches. The height of the bridge, from the deck to the bottom of the drainage will determine whether railings are needed. 2 feet height or less does not require a railing. 2 – 5 feet height should have a railing on one side of the bridge. Over 5 feet in height railings on both sides of the bridge should be built. Railings should be built according to the specifications below.

NOTE: All structures will eventually require maintenance; the KHLCF discourages building structures unless absolutely necessary. In many cases "wet crossings" are preferable to bridges; if the creek rarely holds more than a few inches of water and has a fairly stable surface hikers should be able to wade safely.

Railings

Hand railing should be used where controlling trail user activity and direction is desirable; they should generally be avoided on cliffs or ledges as they may actually encourage visitors to get closer to the edge. The railing should be made from 4 or 6 inch round pressure treated lumber, and consist of two horizontal rails. The top rail should have a maximum height of 42 inches with the lower at mid distance between the ground surface and the top rail. This also applies to railings for footbridges, steps, and stairways.

NOTE: One exception to this design is at trailheads or parking areas. It is often desirable to install more substantial guardrails or fences at access points to deter vehicles or other undesired encroachment. It is also important to maintain good fences at any point where the trail adjoins a boundary.

NOTE: At many access points or trailheads it may be necessary to construct "turnstiles" or offset post entrances to allow hikers to access the trail while discouraging vehicular access. See photo example section.

Trail Surface Options

The goal is to have a firm stable surface throughout the entire length of the trail. In virtually all cases the existing soil should be used with no added materials. Mulch should be avoided. In most cases, it does not compact well to give a stable surface and washes very easily, even on the slightest grades. Gravel, etc, should be avoided as it will wash away into natural areas and also requires regular maintenance. **Remember, forest hiking trails are not roads!**

Note: In virtually all cases, a compacted soil surface (the existing natural surface) will be utilized.

Trail Sign Standards

Trail signs are probably the most important maintenance feature on a trail. The majority of complaints from trail users are the lack of signs on trails. This is especially true of directional signs with appropriate arrows and distances at trail intersections and turns. Every effort should be made to have trails properly marked.

Color

KHLCF recommends tobacco brown signs with yellow lettering, the standard at Kentucky State Parks, which blends in to the natural surroundings. However, any colors and designs are acceptable.

Trailheads

A trailhead is primarily defined as the starting point of a trail or system of trails. This is the optimal location to give the trail user as much information as possible about the trails and their condition. At a minimum, the trailhead should include the following signs:

- A Kentucky Heritage Land Conservation Fund sign, including logo, shall be placed prominently at the trailhead and each access point.

- Standard trail regulations sign, which posts designated uses and prohibited activities.

- A sign with the trail name, total trail length and/or distance to trail destination/terminus. Distances should be given in tenths of a mile. Kentucky State Parks recommends 2” letters.

Trailhead stations/information boards should also be considered. This enables the managing agency to post additional information such as trail maps, current trail conditions, temporary trail closures, activities, and special events.

Consideration should also be given to the proper placement of the signs at the trailhead. Too many signs in one spot can give a cluttered appearance. One way to avoid this is to stagger the signs along the beginning of the trail. For example, the trail name/distance sign could be placed at the very starting point of the trail, with the trail regulation sign placed a short distance down the trail where users will see it once they are on the trail.

Trail Junctions

A sign should be posted at trail intersections. These signs should include the trail name(s), directional arrow(s), and distance to destination and/or trail terminus.

Directional Markers

Other areas along the trail that could be confusing such as sharp turns, or sections that are not well defined should have directional markers to indicate the correct route of travel. For this a "Carsonite" or similar type marker with the appropriate federal recreation symbol(s) and directional arrow decals is recommended. 4" x 4" treated posts with decals or routed arrows can also be utilized. Markers nailed to tree or other methods that would deface trees are to be avoided.

Blazing

Blazing is defined as a method of marking a tree to indicate the direction of a trail. The most common method is by paint. Most trails on KHLCF sites are short and well defined and do not require blazing. If blazing is done care should be taken to use a different color for every different trail route, and none should use the same color as any boundary paint.

NOTE: Proper placement of KHLCF signage is required at all KHLCF funded-sites. This exposure helps the KHLCF raise funds for additional land acquisition and management. Please bear this in mind when designing or redesigning trailhead signs, etc. Contact the KHLCF for more details on sign specifications.

Trail Maintenance and Inspection Procedures

Trails are a major visitor use facility which requires routine maintenance to insure a quality visitor experience and protection of the natural resources. Trail maintenance is defined as the upkeep of the trail corridor, trail surface, trail drainage structures, steps, bridges, and other trail structures. Trail maintenance differs from trail renovation in that the trail is maintained as originally constructed without significant changes to the trail alignment, widths, surface or structures. Trail maintenance begins immediately following trail construction and continues until such time the trail has been closed. The objectives of trail maintenance are:

- To provide for visitor safety and a quality recreational experience.
- To protect the natural resource.
- To preserve the investment in trail planning, design, and construction activities.

Trail maintenance typically involves the following procedures:

- Trail inspections on a regular basis;
- Ranking trail maintenance in priority order.
- Assigning/implementing actual trail maintenance projects.

Trail Inspections

Each trail should be inspected a minimum of two (2) times per year. This is accomplished by walking the trail and visually inspecting the trail conditions. Items or problem areas that can be addressed during the inspection should be corrected at that time. Additional inspections should be made if it is expected that there has been any damage to the trail system. Examples are excessively high winds, torrential rain or flooding, and ice storms.

Ranking Trail Maintenance Projects

Ranking projects in priority order is the second process in a good trail maintenance program. Based upon the information collected during the inspection, trail maintenance projects should be ranked in the following priority order.

- Visitor safety concerns should be addressed first. These items include such things as vandalized or missing trail signs, hazard trees, and weakened or rotten railings, bridges, and steps/stairways.
- Trail degradation concerns should be addressed next. This includes items like boggy or wet trail surfaces, short cut trails, vegetation encroachment, and deteriorated trail surface.

Sample Trail Inspection Report

Trail Inspection Form

Site:	Trail:	Length:	Page 1 of 1
Inspected by:	Title:	Date:	

In box under appropriate item write "P" if problem exists

Location/Site Description	Trail Signs	Railing	Stairways/Steps	Waterbars and/or Drainage Dips	Water Drainage/Runoff	Footbridges	Fallen/Hazard Trees & Limbs	Weeding/Pruning	Undesignated Trails	Debris & Litter	Vandalism	Comments	Inspection Code Work Order #

Inspection Codes: WC = work completed WP = work pending MN = site manager notified WO = work order submitted

Rehabilitation of Damaged Area

In most cases if a trail is well-designed and maintained, rehabilitation will not be necessary. However, sometimes it is necessary to reroute trails or fix problems caused by illegal use (i.e. ATV trespass). In most cases the preferred method is to allow the damaged trail to revegetate naturally. This is a slow process, but one that can be encouraged fairly easily by improving the site soil conditions and blocking the rehab area from use.

Improving site conditions for natural revegetation can be accomplished in just a few steps:

- Close the trail that needs rehabilitation. Sometimes it is necessary to install railings at each end of the trail, but in many cases simply piling up brush and logs will encourage hikers to avoid the area and stay on the “real” trail.

- Scarify soil. This is often just a matter of using a fire-rake to disturb the surface. If the soil is too compacted for this, a drill or auger can be used to make a series of holes in the trail – they should be in a grid pattern, about 6 inches apart in each direction and as deep as you can make them, but 6 to 12 inches will allow drainage.

- Spread logs, brush, and leaves to improve natural revegetation. Only use materials from the adjacent forest. Spread randomly, not in rows or piles (except at the end of the trail to block access as mentioned above).

- Consider hand-spreading slow release organic fertilizer.

- Consider hand-seeding non-invasive annual rye or winter wheat. Be sure you are only using annual, weed-free seeds.

- Consider transplanting very small trees and shrubs from nearby forest onto the old trail. Space them generously – shrubs or small trees (dogwoods, spicebush) should be twenty feet apart, larger trees (oaks, poplars) should be thirty feet apart.

NOTE: Try to rehabilitate in the fall or winter when native plants are dormant.

Common Trail Issues

It is extremely important to carefully monitor the conditions of all trails. Unsafe conditions as a result of neglect, which can include failure to inspect and provide simple maintenance, can result in accidents and legal action. Please note the following inspection areas:

Water drainage problems: Look for trail rutting or where water stands on trail surface. Trail sections with minimum grades can utilize culverts or water dips. On steeper grades, properly placed dips or water-bars may be required.

Fallen tree removal: All trails should be kept clear from downed trees as frequently as possible. Logs or snags in the woods, away from the trail, should be left for wildlife habitat.

Weeding/Pruning: Many trails traverse open areas, which in the summer become thick with grasses. These areas will require the use of a weed-eater occasionally during the growing season. Mowers or rotary cutters should not be used because they cut too wide and can cause damage and drainage problems to the trail surface. The hanging limbs should be removed with lopping shears.

Undesignated trails: Many visitors create their own trails, especially at switchbacks. Efforts should be made to cover and brush these “renegade” trails over with branches, treetops, leaves and other natural debris. This will discourage use and encourage new vegetation growth. In some cases, installing handrails may be the best option to direct traffic flow. Undesignated trails often cause serious erosion problems if ignored.

Vandalism: Log and report any vandalism to the proper legal authorities immediately. Repair or replace any damage or missing signage immediately. Contact the KHLCF if warranted.

Trailhead signage: Signs located at the trailhead should include (1) sign with trail name, length of trail and/or distance to destination, (1) trail safety/regulation signs and (1) Kentucky Heritage Land Conservation Fund sign.

Directional and/or safety signage: A check should be to determine that all signs or areas where signs are needed clearly mark direction, distance, and warnings. These are especially needed at sharp turns in a trail or where trails intersect. Lack of proper directional signage is among the biggest complaints from park visitors who become disoriented while on a trail.

Railings, steps, stairways, and bridges: Check for rotten or weak materials and joints. Steps sometimes slip or tilt forward and become unstable. Unsafe trail structures present the greatest potential for park negligence and liability in trail accidents.

Trail surface: Erosion and trail washouts are the primary concern here. Check for rutting, loss of soil or surface materials. Also, properly angled cross slope should be maintained. Trail surfaces with and excessive cross slope should be cut so the surface has a 2-3% cross slope. This will allow for proper drainage. Where trail surface material is needed to fill ruts, wet areas, etc., fill dirt from on site is the most practical alternatives.

Water-bars & Drainage Dips: These are very effective for controlling erosion and routing water off the trail. Small logs obtained on site, or round treated posts make the best water-bars. Bury about 2/3% in grade and extend beyond the width of trail at a 45 - 60 degree angle. Drainage dips are simply manually constructed earthen water-bars.

Trail Design, Construction, and Funding Resources

NOTE: All these are excellent sources in trail management. However, before you implement any of their methods make sure you are choosing the most practical method for the KHLCF site you manage. For example: if your site has two miles of lightly used trails on a steep slope in Kentucky, management methods used on a fifty mile trail in the Arizona desert will not be the best choice. Contact the KHLCF office with any questions.

- KHLCF Biologist Consultant: http://heritageland.ky.gov

The website of the non-profit group "American Trails" has an extensive library of trail design and construction resources: www.americantrails.org/resources/ .

The following two books are very highly recommended, and available from the Appalachian Trail Conference (304-535-6331 or www.atconf.org):

- *Appalachian Trail Design, Construction, and Maintenance,* by William Birchard, Jr. and Robert Proudman.
- *A.T. Fieldbook: Maintenance & Rehabilitation Guidelines*

The ATC has several other resources available on-line, but none are as complete as the above books:
http://www.atconf.org/what-we-do/trail-management-support/volunteer_toolkit/reference-materials

Another excellent book is:
The Complete Guide to Trail Building and Maintenance 3rd Edition, by Carl Demrow and David Salisbury.
Appalachian Mountain Club Books

More suggests can be found at the web-site of the Professional Trailbuilders Association: www.trailbuilders.org/resources/books1.html

Funding for trails

Kentucky Department for Local Government Recreational Trails Program

- http://dlg.ky.gov/grants/federal/rtp.htm

American Hiking Society National Trails Fund

- http://www.americanhiking.org/our-work/national-trails-fund/

Federal Highway Administration Transportation Enhancement grants

- http://transportation.ky.gov/local-programs/pages/transportation-enhancements.aspx

KHLCF Sign Graphics

Contact the KHLCF office for higher resolution image.

Photo Examples

CORRECT: properly place KHLCF sign in trailhead kiosk.

CORRECT: trail width is only two feet wide, which allows trees to shade the trail and prevent weed/grass growth – very low maintenance.

CORRECT: Dip/water-bar construction; water is caught by the trench and directed off of the trail instead of flowing down the trail and creating an erosion problem. Multiple dips have been constructed as needed – in this case approximately every fifty feet down the trail.

CORRECT: In-ground stone steps installed in a steep, erodible area. Treated lumber may also be used, typically 6x6 posts cut to 2 foot lengths.

INCORRECT: water is eroding the trail down the middle and "channeling"; damaging to the environment and hazardous to visitors; needs water-bars or steps.

CORRECT: In-ground stone steps installed in a steep, erodible area along a creek. An example of a "wet crossing" or "low-water crossing; building footbridges is not generally needed at ephemeral creeks (ones that only have water when it rains).

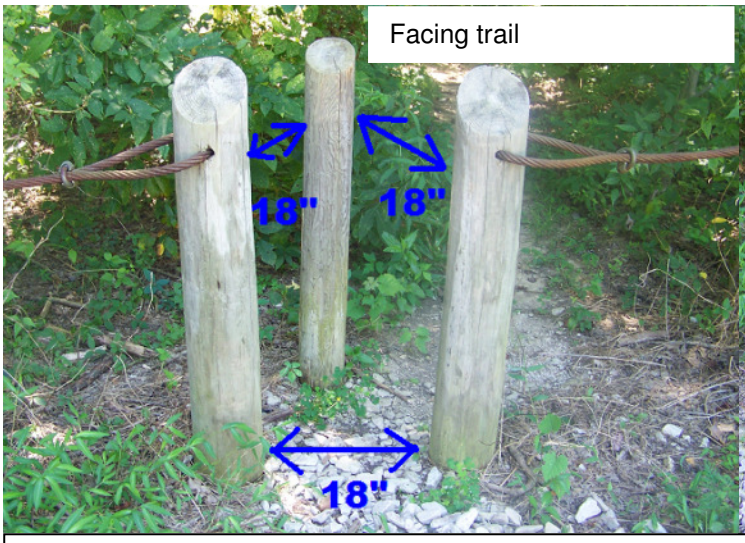
CORRECT: "Cribbing" has been installed along the trail on the downhill side to keep soil from washing away.

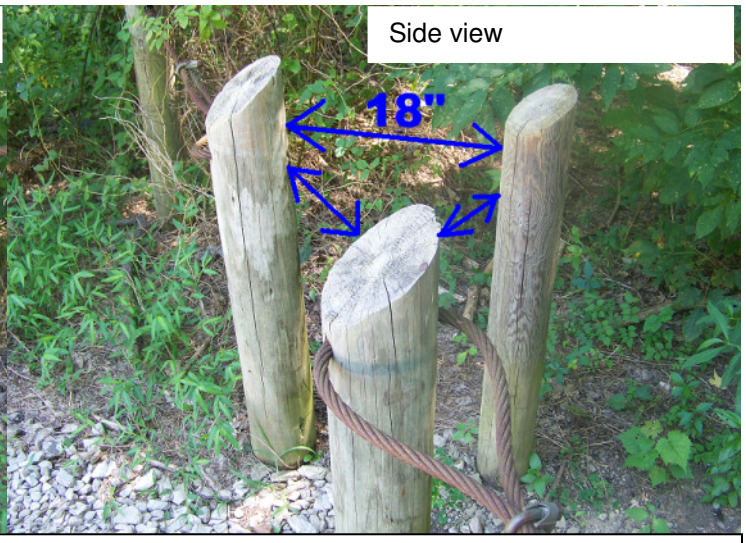
INCORRECT: trail width is kept ten feet wide, which prevents trees from growing and shading the trail and allows weed/grass growth; gravel washes into surrounding forest and must be replaced periodically -very high maintenance and damaging to the environment.

INCORRECT: trail width is kept ten feet wide, which prevents trees from growing and shading the trail, allowing weed/grass growth; requires regular mowing – very high maintenance.

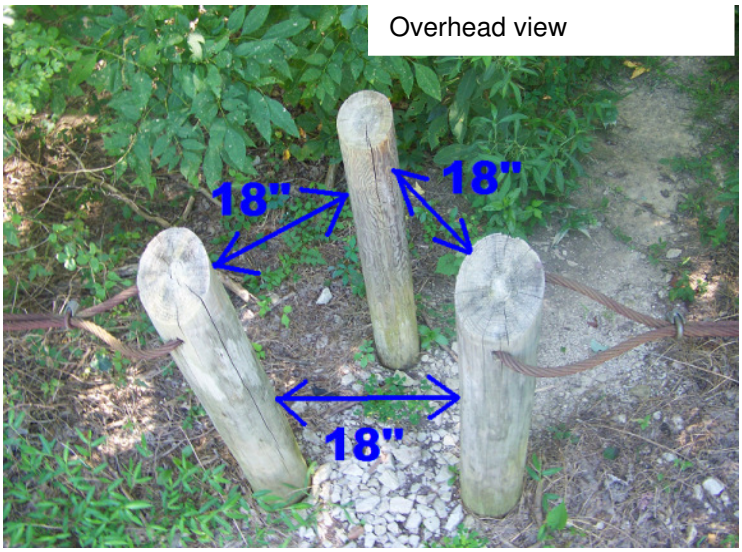
CORRECT: Railing used to protect fragile habitat or restoration area. Photo by Brian Gasdorf.

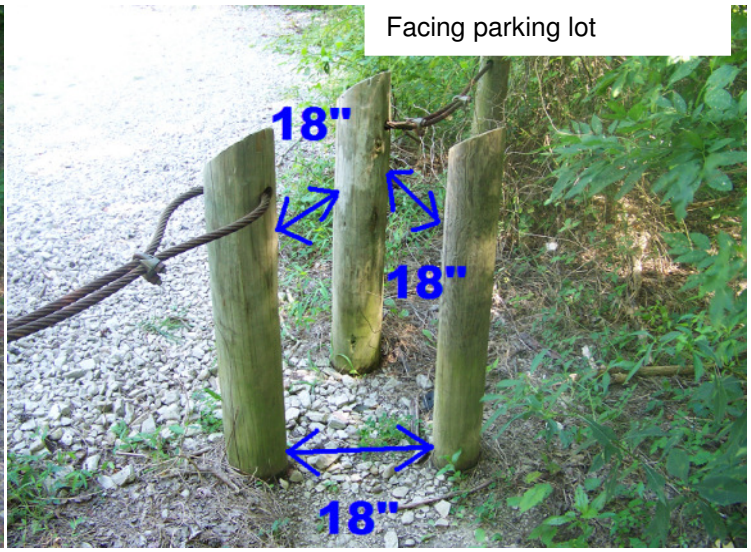
CORRECT: Elaborate staircases should be avoided; however, in some cases they are necessary due to steep cliffs, etc. The angles incorporated in this design helps discourage undesired use by vehicles, etc.





CORRECT: Offset-post trail entrances at parking lots allow hiking access but discourage vehicles, etc. Simply space two posts 18 inches apart, then install a third post between those two, but offset behind them forming a triangle with 18 inch gaps between each post. The rest of the parking lot should be railed or cabled off.





CORRECT: trail with “blaze” painted along it helps keep hikers on the right path.

CORRECT: Tree has fallen across the trail; a notch was cut out allowing easy hiking but discouraging vehicles.